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Dual-inlet selective flow control valve

The present invention relates to fluid distribution and control valves, in particular for an onboard system for delivering respiratory gas to a passenger.

Pilots of modern aircraft, in particular of fighter planes, are supplied with respiratory gas by systems which deliver pure oxygen or an oxygen-enriched mixture.

A control valve of the proportional type with one inlet and two outlets for an onboard system for delivering respiratory gas is described in EP-A-0 499 505 (Zapata et al.).

In current practice, an emergency oxygen source is provided as standard in order to deal with possible failure of the main oxygen source, and a selector element, activated automatically or manually, allows the user to switch the inlet of the control valve to the main source or, if this fails, to the emergency source.

The object of the present invention is to propose a novel architecture of a fluid distribution and control valve combining the function of selection between two sources of fluid and the function of conventional control, using a single mobile structure of greatly simplified and compact arrangement and of increased reliability.

To do this, according to one characteristic of the invention the fluid distribution and control valve comprises a valve body defining four internal zones which are each connectable to an external fluid circuit, and a mobile structure which can be moved into at least four positions in order to selectively

establish a fluid communication between two of these zones and to isolate each of the two other zones, a first of these zones being connectable to a user fluid circuit and being able to be selectively brought into communication with each of the three other zones depending on the movement of the mobile structure.

According to other characteristics of the invention, the valve comprises:

- a second zone and third zone which are connectable, respectively, to first and second sources of pressurized fluid in order to supply the user fluid circuit sequentially,

- the mobile structure, typically composed of a slide or rotor sliding or turning, respectively, in partition walls delimiting the different zones, is connected to a positioning servomotor.

The present invention also relates to an onboard system for delivering respiratory gas to a passenger, said system comprising such a valve, and the sources of pressurized fluid typically being a main oxygen source and an emergency oxygen source.

Other characteristics and advantages of the present invention will become clear from the following description of an embodiment given by way of example and not intended to be limiting. In the description, reference is made to the attached drawings, in which:

- Figure 1 is a schematic view of an onboard system for delivering respiratory gas to a passenger, in a first configuration according to the invention; and

- Figures 2 and 3 are schematic views showing other configurations of the distribution and control

valve from Figure 1.

In the embodiment shown schematically in the figures, a fluid distribution and control valve according to the invention comprises a valve body 1, whose general configuration is advantageously cylindrical, and in which are formed a multiplicity of zones separated from one another by partition walls provided with through-orifices which can be selectively closed or opened by means of a valve slide designated generally by reference number 2.

More specifically, as is shown in Figure 1, the valve body 1, whose general configuration is substantially symmetrical with respect to a center plane perpendicular to the axis of the slide 2, comprises, in the center plane and on either side of the slide 2, a first zone 3 provided with a fluid inlet/outlet passage 4 formed in the valve body 1, and a fourth zone 5 provided with a fluid inlet/outlet passage 6 formed in the valve body 1.

The zones 3 and 5 are separated, by partition walls 7 and 8, respectively, from a first intermediate chamber 9 and from a second intermediate chamber 10 which are themselves separated, respectively, by partition walls 11 and 12, from a second zone 13 provided with a fluid inlet/outlet passage 14, and from a third zone 15 provided with a fluid inlet/outlet passage 16.

The partition walls 7, 8, 11, 12 are mutually parallel and in each case comprise a through-opening such as those identified as 17, 18 and 19 in the figures, which through-openings are formed in alignment with one another and in which there slides the slide 2 of cylindrical shape provided locally with a thinner zone (20), advantageously of varying profile, making it possible, depending on the position of the slide, to allow fluid to pass through one of the openings, such

as 17 to 19, and to control the flow of fluid thus passing from a zone to a chamber, and vice versa, in the body of the valve.

As can be seen from the figures, in the configuration according to Figure 1 the slide 2 establishes a communication, via the opening 17, between the second zone 13 and the chamber 9. The zones 5 and 15 and the chamber 10 are each isolated. In the configuration according to Figure 2, the slide 2 permits communication, via the opening 18, between this intermediate chamber 9 and the fourth zone 5, while the zones 13 and 15 and the chamber 10 are isolated. In the configuration according to Figure 3, the slide 2 establishes a communication, via the opening 19, between the other intermediate chamber 10 and the third zone 15, while the zones 13 and 5 and the chamber 9 are isolated. In an intermediate configuration (not shown) between the ones in Figures 2 and 3, the slide, when symmetrical with respect to Figure 2, permits communication between the fourth zone 5 and the second intermediate chamber 10 through the opening which is formed in the partition wall 8 and which is traversed by the slide 2.

In the embodiment shown, the first zone 3 is in permanent communication with the intermediate chambers 9 and 10 via openings 21 and 22 formed, respectively, in the partition walls 7 and 8.

The slide 2 can be continuously positioned, between the end position in Figure 1 and the end position in Figure 3, by means of an electric or pneumatic servomotor 23, the position of the slide being detected permanently by a position detector 24 of the electromagnetic or optical type which delivers a precise position control signal to the control unit of the servomotor, thus permitting fine adjustment of the flow of fluid authorized to pass through one of the openings, such as

17.

The function of the valve in its application to an onboard system for delivery of oxygen to an aircraft pilot will now be described.

In such a system, the first zone 3 is connected via the passage 4 to a user circuit U supplying the pilot's mask M. The second zone 13 is connected via the passage 14 to a main source S_1 of oxygen, for example an oxygen generator of the adsorption or permeation type, and the fluid passage 16 of the third zone 15 is connected to an emergency source S_2 of gaseous or liquid oxygen. The fluid passage 6 of the fourth zone 5 is connected to a vent circuit 25 opening to outside the cockpit.

Figure 1 shows the configuration for control of a flow of oxygen from the source S_1 to the mask M in order to automatically control the respiratory flow required by the user by modulating the passage in the opening 17. In this configuration, the third zone 15 and the second chamber 10 are isolated from the other zones.

Figure 2 shows the position for venting of the user circuit U by moving the slide 2 from the configuration in Figure 1, the second zone 13 thus being isolated and the intermediate chamber 9 establishing communication between the first zone 3 and the fourth zone 5 for venting the gaseous mixture from the user circuit to the outside via the passage 6.

Figure 3 shows the symmetrical configuration of the one in Figure 1, the user circuit U now being supplied with oxygen from the emergency source S_2 via the third zone 15, the control opening 19 in the partition wall 12, the second intermediate chamber 10 and the first zone 3. In this configuration, the second zone 13 and the fifth zone 5 are isolated from the other zones.

Although the present invention has been described with reference to a specific embodiment, it is not limited to the latter and is instead open to modifications and variations which will be obvious to the skilled person from the scope of the claims attached. In particular, the particular structure of the slide 2 and of the cooperating openings such as 17, 18 and 19 can be adapted with varying profiles, and the slide can be replaced by a rotary valve element opening into zones which are spaced angularly apart in the valve body and are separated by radial partition walls.